

PRELIMINARY DATA SUMMARY

February 1992

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Clifford F. Baron at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

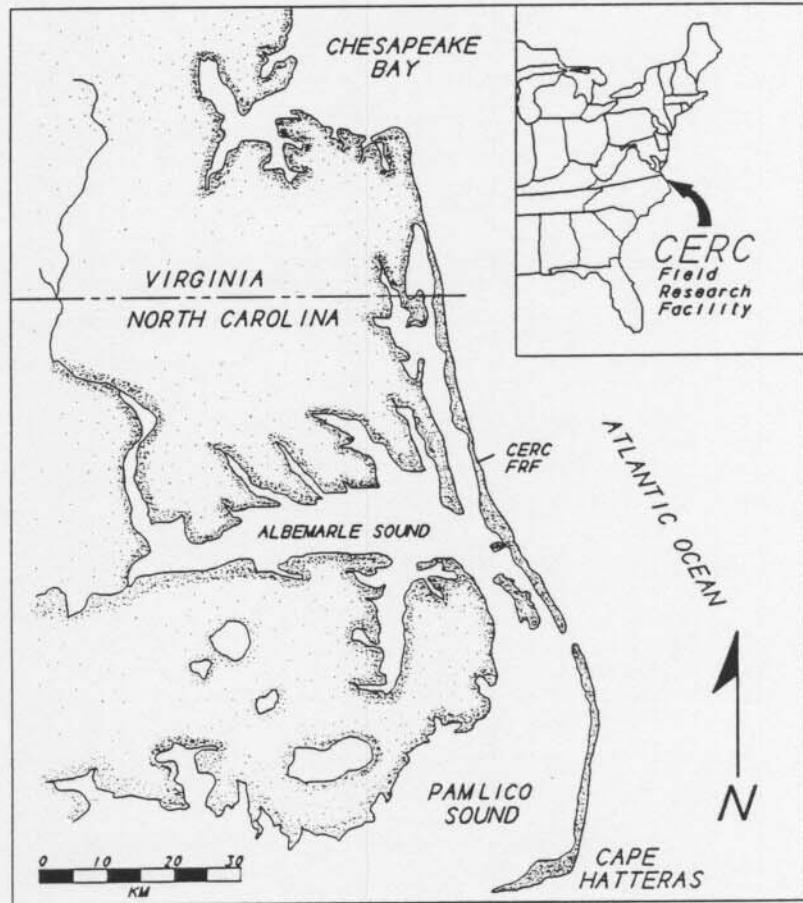


Figure 1. FRF location map

Table 1: Instrument Status/Data Availability

FEB 1992

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																												
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
616	Barometric Pressure		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*		
			Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
604	Precipitation		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
624	Air Temperature		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*		
932	Anemometer at seaward end of pier Elevation 19 m (NGVD)		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*
625	Baylor staff at station 18+60 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
			Data Collected	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
519	Current meter 320 m north of FRF pier (0.9 km offshore)	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
	Supplemental Observations (daily oceanographic and meteorological observations)		Daily observation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		

Gage Status	Daily Observation	Analog Record	Data Collected
Operational = *	Complete = *	Complete = *	All = *
Partial = /	Partial = /	Partial = /	Partial = /
Non-Operational = -	None = -	None = -	None = -

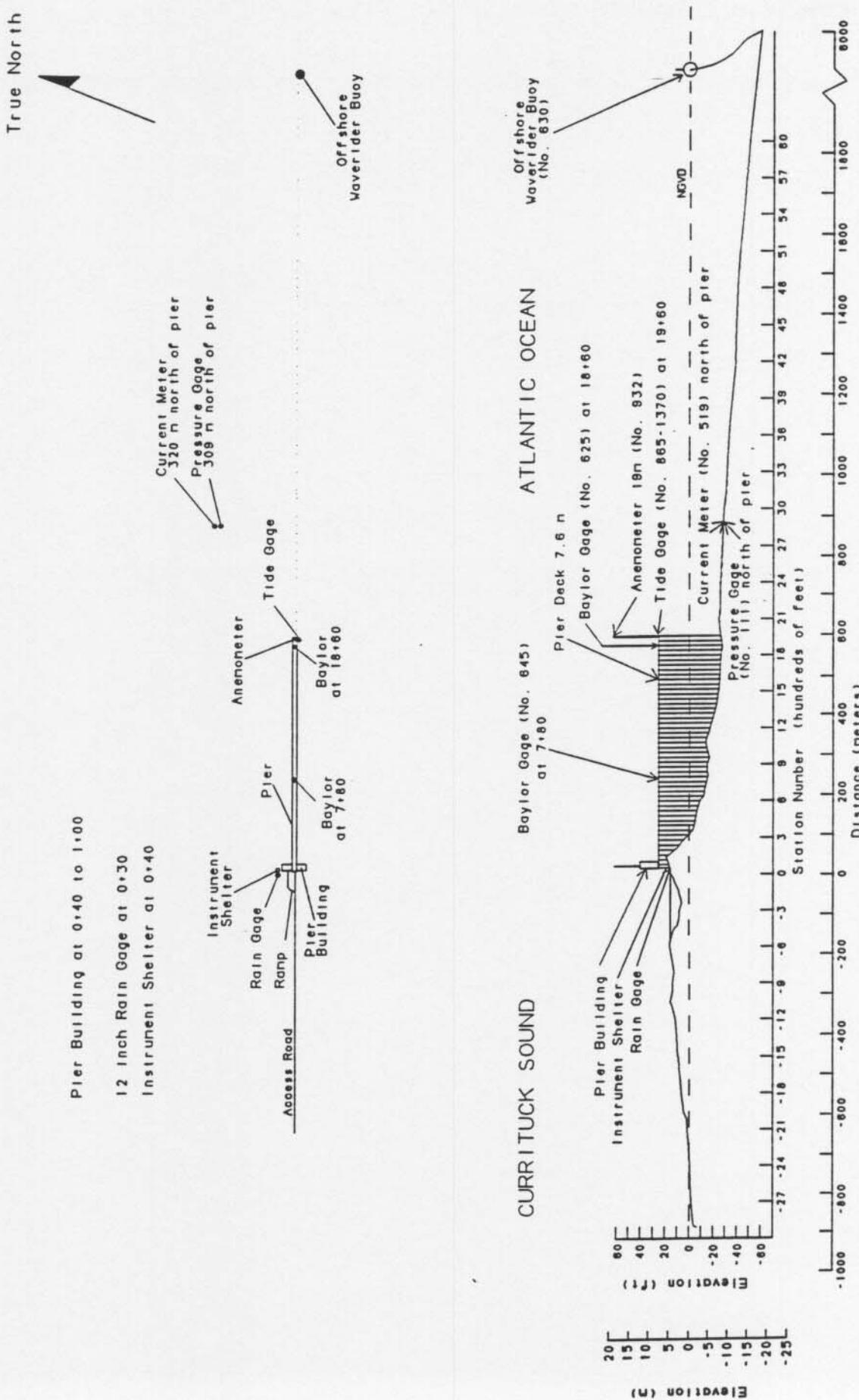


Figure 2. Instrument locations at FRF (all elevations from NGVD, all distances from FRF baseline).

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $mm \times .03937 = in.$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $mb \times 0.02953 = in. Hg$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

Table 2: Meteorological Data

Feb 1992

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	6	327	6.0	1004.7	0
	700	10	328	4.1	1007.4	0
	1300	13	333	6.1	1008.0	0
	1900	7	307	4.4	1010.0	0
2	100	11	325	0.8	1013.4	0
	700	10	322	-0.5	1016.1	0
	1300	6	302	5.4	1015.3	0
	1900	5	295	4.7	1014.7	0
3	100	6	354	4.5	1015.1	0
	700	10	8	4.8	1015.7	0
	1300	0		6.5	1015.2	0
	1900	3	22	5.4	1015.4	0
4	100	1	312	2.5	1015.0	0
	700	3	207	3.6	1013.4	0
	1300	6	188	13.1	1008.0	0
	1900	6	204	11.1	1003.6	0
5	100	12	13	7.5	1005.3	0
	700	12	8	4.9	1009.8	0
	1300	11	3	4.9	1010.7	0
	1900	9	29	4.7	1011.7	0
6	100	10	40	5.0	1010.8	0
	700	12	46	6.0	1008.6	0
	1300	13	43	7.3	1005.3	0
	1900	12	39	7.1	1002.8	0
7	100	13	27	7.6	998.5	0
	700	12	9	7.0	996.5	0
	1300	12	351	6.8	996.2	0
	1900	9	16	6.2	999.5	0
8	100	5	22	5.4	1001.5	0
	700	4	336	3.4	1002.5	0
	1300	5	352	5.7	1003.6	0
	1900	3	328	2.9	1009.7	0
9	100	7	294	2.2	1014.8	0
	700	5	313	-0.1	1020.7	0
	1300	2	52	4.5	1023.0	0
	1900	4	77	3.0	1027.7	0
10	100	10	33	2.8	1028.9	0
	700	9	54	2.2	1033.4	0
	1300	8	47	4.5	1031.0	0
	1900	8	58	5.4	1029.3	0
11	100	4	46	6.9	1026.0	0
	700	3	353	6.1	1024.7	0
	1300	4	1	6.4	1022.8	0
	1900	3	223	6.7	1020.9	0
12	100	3	243	6.9	1021.3	0
	700	12	39	5.4	1025.0	0
	1300	11	32	2.1	1029.3	0
	1900	8	42	1.1	1029.8	0
13	100	7	66	3.9	1027.3	0
	700	8	49	5.6	1023.4	0
	1300	8	19	9.2	1016.6	13
	1900	5	261	9.6	1014.0	0
14	100	5	251	10.9	1013.7	3
	700	8	259	8.3	1015.2	0
	1300	5	2	9.0	1017.2	0
	1900	4	1	6.8	1020.2	0
15	100	3	121	7.3	1020.4	0
	700	6	137	8.6	1018.4	0
	1300	9	155	13.0	1013.2	0
	1900	10	198	17.0	1009.2	0
16	100	9	235	15.2	1007.2	0
	700	7	226	13.3	1008.3	0
	1300	7	253	16.4	1009.2	0
	1900	7	295	13.4	1015.2	0

* electronic problems

(Continued)

(Sheet 1 of 2)

Table 2: Meteorological Data

Feb 1992

Day	Hour	Wind	Wind	Temperature	Atm	Precipitation
		Speed m/sec	Direction deg TN	deg C	mb	mm
17	100	5	16	6.7	1021.0	0
	700	7	19	6.5	1025.0	0
	1300	5	26	7.7	1025.1	0
	1900	4	34	7.5	1024.1	0
18	100	8	74	9.4	1017.1	0
	700	5	32	11.9	1014.4	9
	1300	5	265	12.5	1013.4	0
	1900	4	247	11.3	1016.1	3
19	100	5	191	12.8	1015.4	0
	700	7	187	19.5	1011.1	3
	1300	3	251	18.7	1009.7	0
	1900	2	221	13.9	1010.1	0
20	100	6	228	11.9	1011.1	0
	700	5	305	10.3	1015.7	0
	1300	6	1	11.5	1018.3	0
	1900	4	153	7.1	1022.2	0
21	100	4	295	7.8	1023.6	0
	700	3	215	7.8	1024.2	0
	1300	9	254	15.1	1023.1	0
	1900	4	233	12.2	1024.6	0
22	100	4	69	8.2	1025.6	0
	700	3	145	8.4	1025.8	0
	1300	5	219	17.6	1023.8	0
	1900	6	185	14.2	1022.6	0
23	100	4	186	13.7	1020.6	0
	700	2	136	9.4	1019.2	0
	1300	3	111	11.3	1016.5	0
	1900		Hardware Error			0
24	100	8	58	12.7	1012.5	0
	700	2	9	12.3	1013.7	0
	1300	3	16	9.1	1014.6	0
	1900	7	356	9.9	1016.1	0
25	100	6	356	9.4	1016.6	0
	700	7	357	9.1	1016.2	0
	1300	5	357	8.6	1014.0	0
	1900	4	6	9.4	1010.0	0
26	100	9	187	19.3	1001.7	4
	700	8	4	11.6	998.5	0
	1300	3	12	10.1	998.6	3
	1900	3	25	7.9	1002.3	0
27	100	2	132	8.0	1004.7	0
	700	3	307	6.7	1007.0	0
	1300	6	240	9.7	1007.2	0
	1900	5	267	11.3	1007.4	0
28	100	5	241	9.7	1009.0	0
	700	5	251	9.4	1009.7	0
	1300	6	246	15.3	1006.5	0
	1900	8	210	13.1	1002.9	0
29	100	11	229	13.2	998.0	0
	700	12	280	13.2	998.9	0
	1300	15	359	5.9	1008.8	0
	1900	9	8	5.0	1017.1	0
		Resultant		Mean	Mean	Total
		3	353	8.4	1014.2	38

* electronic problems

(Sheet 2 of 2)

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on optical disc using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 3 hr. This report reflects the data collection periods of 0100, 0700, 1300, and 1900 EST. The results are based only on the first 34 minute record. The sampling rate is two times per second for five contiguous 34-min records.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to optical disc.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Feb 1992

Day	Hour	645		625		111		630	
		Baylor at 7+80 Hmo,m	T.sec	Baylor at 18+60 Hmo,m	T.sec	Pressure Gage Hmo,m	T.sec	Offshrd Wvrdr Hmo,m	T.sec
1	0100	0.58	4.41	0.75	4.34	0.71	4.74	Wvrdr	
	0700	1.46	5.69	1.39	6.40	1.53	6.09		
	1300	1.09	6.09	1.41	6.74	1.47	6.56		
	1900	1.30	6.40	1.38	6.74	1.43	7.11		
2	0100	1.37	6.74	1.56	6.92	1.64	7.53	Wvrdr	
	0700	1.36	6.09	1.57	8.53	1.67	8.00		
	1300	0.99	5.69	1.41	8.53	1.47	9.14		
	1900	0.95	6.24	1.19	11.13	1.20	10.67		
3	0100	0.59	12.19	1.16	12.19	1.20	11.13	Wvrdr	
	0700	1.37	5.95	1.61	12.19	1.66	11.64		
	1300	0.98	12.80	1.46	12.19	1.54	12.19		
	1900	1.03	12.19	1.32	11.64	1.27	12.19		
4	0100	0.49	12.19	1.06	11.13	1.11	11.13	Wvrdr	
	0700	0.62	11.64	0.93	11.64	0.96	11.13		
	1300	0.33	10.67	0.81	11.13	0.83	10.67		
	1900	0.50	10.67	0.69	10.24	0.78	10.67		
5	0100	0.33	2.41	0.60	9.85	0.52	9.85	Wvrdr	
	0700	1.42	5.82	1.42	6.09	1.39	5.69		
	1300	1.12	6.40	1.42	6.40	1.54	6.92		
	1900	1.18	5.69	1.20	6.24	1.15	6.24		
6	0100	0.70	4.49	1.08	4.83	0.99	4.57	Wvrdr	
	0700	1.48	5.82	1.59	6.09	1.54	5.82		
	1300	1.41	6.40	1.96	6.74	2.14	6.56		
	1900	1.80	6.92	2.24	7.31	2.23	7.53		
7	0100	1.80	11.13	2.33	8.00	2.38	7.76	Wvrdr	
	0700	1.93	10.24	2.91	10.67	2.85	10.67		
	1300	1.79	11.64	2.70	10.67	2.81	10.24		
	1900	2.04	11.13	2.87	11.13	3.15	11.64		
8	0100	2.15	12.80	2.49	12.80	2.54	11.13	Wvrdr	Gage Inoperative
	0700	1.99	11.64	2.28	12.80	2.55	11.64		
	1300	1.91	12.19	2.11	11.64	2.27	12.19		
	1900	1.61	12.19	1.93	12.19	1.80	11.64		
9	0100	1.02	12.80	1.44	12.80	1.40	13.47	Wvrdr	
	0700	0.76	12.19	1.21	12.19	1.46	11.64		
	1300	0.65	12.80	0.97	12.19	1.11	12.80		
	1900	0.33	12.80	0.84	12.80	0.91	12.80		
10	0100	0.94	4.13	1.05	12.19	1.01	12.80	Wvrdr	
	0700	0.93	5.95	1.42	6.24	1.40	6.09		
	1300	0.76	5.33	1.16	6.24	1.21	6.24		
	1900	0.77	4.57	1.09	6.40	1.09	5.82		
11	0100	0.79	5.02	0.98	5.12	0.98	5.33	Wvrdr	
	0700	0.64	4.83	0.86	6.24	0.83	5.22		
	1300	0.52	6.24	0.70	4.92	0.73	6.24		
	1900	0.48	7.53	0.71	7.11	0.69	7.31		
12	0100	0.73	7.11	0.69	7.76	0.69	7.53	Wvrdr	
	0700	0.72	3.88	1.16	3.94	1.05	3.88		
	1300	1.60	6.74	1.96	6.74	1.99	6.74		
	1900	1.03	6.24	1.44	8.26	1.55	8.26		
13	0100	1.10	9.14	1.27	9.85	1.28	10.24	Wvrdr	
	0700	0.78	9.85	1.30	8.53	1.31	7.76		
	1300	0.97	5.33	1.25	4.83	1.18	5.12		
	1900	1.08	7.76	1.24	8.00	1.26	8.26		
14	0100	1.03	8.00	1.10	8.83	1.07	8.26	Wvrdr	
	0700	0.35	8.53	0.61	8.00	0.63	8.83		
	1300	0.40	9.14	0.60	9.14	0.61	8.53		
	1900	0.28	8.83	0.56	9.48	0.55	9.48		
15	0100	0.46	7.76	0.59	8.83	0.64	9.48	Wvrdr	
	0700	0.58	9.85	0.65	9.85	0.62	10.24		
	1300	0.38	9.48	0.69	9.48	0.64	9.14		
	1900	0.94	7.53	1.04	7.53	1.10	7.31		
16	0100	0.66	8.00	0.83	9.14	0.84	7.11	Wvrdr	
	0700	0.80	9.85	0.74	9.85	0.77	8.83		
	1300	0.48	9.85	0.57	9.85	0.57	9.85		
	1900	0.47	9.14	0.45	9.48	0.46	9.14		

* Electronic problems

(Continued)

Table 3: Wave Data

Feb 1992

Day	Hour	645		625		111		630	
		Baylor at 7+80 Hmo,m	T.sec	Baylor at 18+60 Hmo,m	T.sec	Pressure Gage Hmo,m	T.sec	Offshr Wvrdr Hmo,m	T.sec
17	0100	0.39	7.76	0.48	7.53	0.51	8.83		
	0700	0.68	4.20	0.77	4.34	0.69	4.20		
	1300	0.63	4.83	0.85	6.24	0.89	5.82		
	1900	0.71	5.22	0.83	5.45	0.75	6.40		
18	0100	0.73	3.88	0.95	3.66	0.88	4.06		
	0700	0.87	4.83	1.13	5.69	1.00	5.02		
	1300	1.06	7.53	1.14	8.26	1.13	7.76		
	1900	0.76	7.76	0.93	7.76	0.96	7.76		
19	0100	0.62	6.74	0.67	7.53	0.74	7.53		
	0700	0.51	6.56	0.68	8.53	0.64	8.26		
	1300	0.47	6.24	0.51	6.92	0.47	9.14		
	1900	0.45	5.69	0.54	9.48	0.50	9.85		
20	0100	0.39	6.09	0.44	9.48	0.43	10.67		
	0700	0.47	6.74	0.50	9.48	0.44	9.85		
	1300	0.36	6.92	0.43	9.48	0.38	8.83		
	1900	0.38	8.83	0.41	9.48	0.40	8.53		
21	0100	0.19	7.31	0.32	9.48	0.33	8.83		
	0700	0.27	8.83	0.29	8.83	0.30	8.26		
	1300	0.17	9.14	0.27	8.26	0.27	9.85		
	1900	0.14	9.14	0.24	9.14	0.27	8.83		
22	0100	0.13	8.53	0.25	9.85	0.26	9.48		
	0700	0.19	8.83	0.33	8.83	0.31	9.14		
	1300	0.19	9.14	0.41	3.88	0.37	9.14		
	1900	0.21	8.83	0.44	8.83	0.42	8.83		
23	0100	0.49	8.83	0.46	9.14	0.43	9.48	Gage	
	0700	0.27	9.14	0.46	9.14	0.48	8.83	Inoperative	
	1300	0.43	8.53	0.47	8.83	0.50	8.83		
	1900			Hardware Error					
24	0100	0.93	7.11	0.83	6.92	0.72	6.92		
	0700	0.56	6.92	0.84	7.11	0.84	7.11		
	1300	0.65	8.26	0.70	6.56	0.70	6.56		
	1900	0.43	7.11	0.80	5.82	0.82	6.92		
25	0100	0.94	7.53	1.27	7.76	1.25	7.53		
	0700	0.58	7.11	1.17	8.53	1.25	8.26		
	1300	0.89	8.53	1.16	8.83	1.15	9.14		
	1900	0.43	8.83	1.05	9.48	1.10	8.83		
26	0100	0.76	9.85	1.11	8.83	1.16	9.48		
	0700	0.71	7.76	0.98	7.76	1.00	9.48		
	1300	1.24	11.13	1.22	10.24	1.25	9.85		
	1900	0.70	10.67	0.98	10.67	1.09	10.67		
27	0100	0.83	9.48	0.94	9.48	0.90	9.48		
	0700	0.44	6.40	0.76	6.92	0.81	6.40		
	1300	0.52	9.48	0.69	9.48	0.70	9.48		
	1900	0.28	9.14	0.54	9.48	0.56	9.14		
28	0100	0.35	8.83	0.40	9.14	0.44	9.14		
	0700	0.20	8.83	0.34	8.53	0.38	9.14		
	1300	0.22	8.83	0.36	9.85	0.40	9.14		
	1900	0.24	8.83	0.40	8.83	0.38	9.14		
29	0100	0.26	8.83	0.38	8.83	0.38	8.83		
	0700	0.22	7.76	0.33	8.00	0.34	8.83		
	1300	1.53	6.56	1.80	6.56	1.93	6.40		
	1900	1.28	6.24	1.57	7.53	1.64	8.00		
Mean		0.79	8.04	1.02	8.54	1.04	8.58		
Std dev		0.48	2.37	0.58	2.17	0.61	2.09		

* Electronic problems

(Sheet 2 of 2)

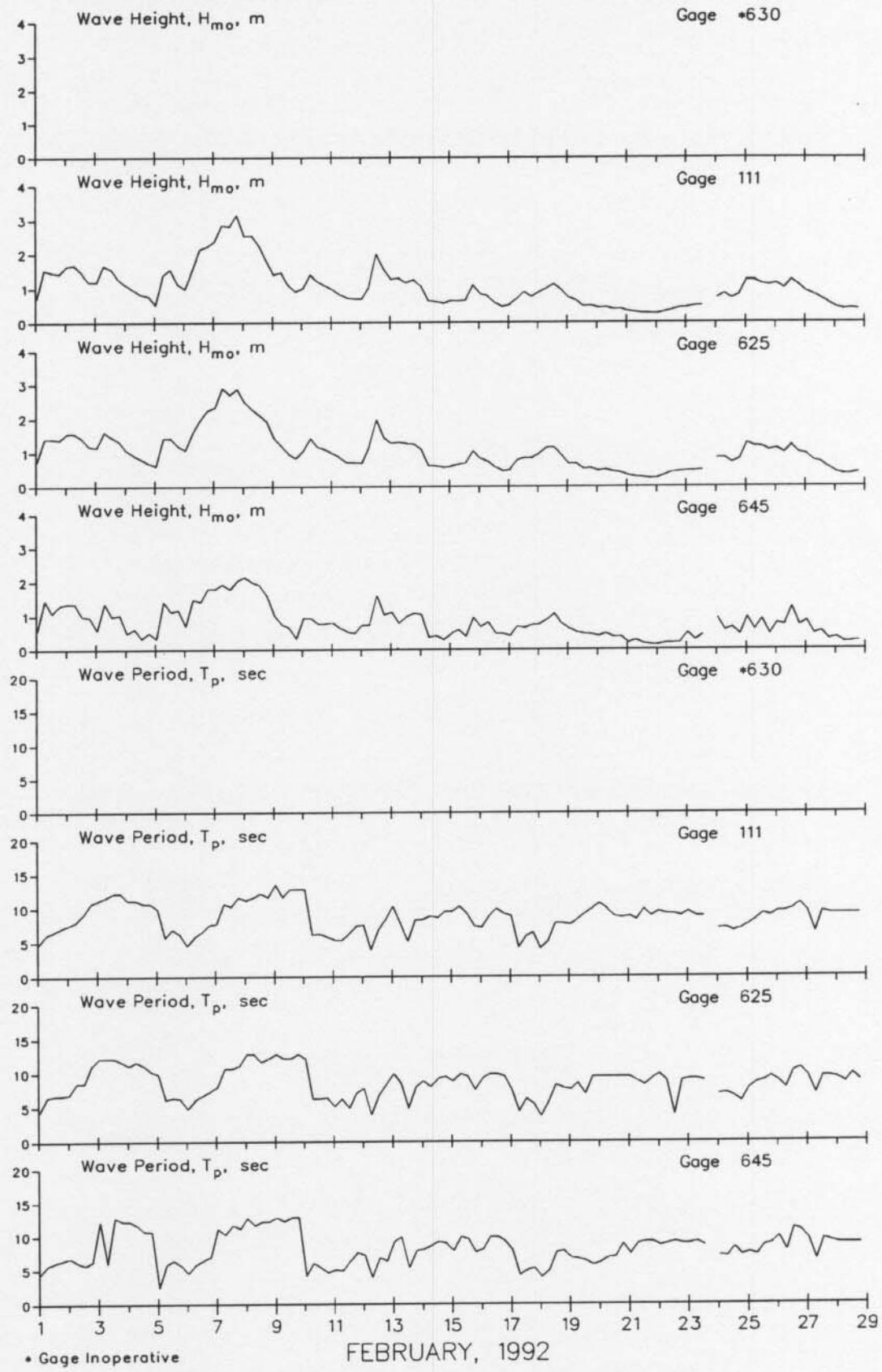


Figure 3. Time history of wave heights and periods

PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Feb 1992

Alongshore Cross-shore Resultant ---- Time	Pier Measurements				Beach Measurements			Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Dye at Mid-Surf Zone (surface)	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519
Day	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	
1 0100-Along Cross Result							17	S	
							5	off	
							18	144	
1 0700-Along Cross Result	55 0	S 160	165	30 0	S	North	60	S	27
							11	off	
							29	138	
1 1300-Along Cross Result							41	S	
							13	off	
							43	142	
1 1900-Along Cross Result							33	S	
							12	off	
							36	140	
2 0100-Along Cross Result							46	S	
							15	off	
							48	142	
2 0700-Along Cross Result	41 12 42	S off 143	168	68 0 68	S 160	North	24	S	41
							13	off	
							43	143	
2 1300-Along Cross Result							36	S	
							10	off	
							37	145	
2 1900-Along Cross Result							24	S	
							4	off	
							24	150	
3 0100-Along Cross Result							18	S	
							8	off	
							19	135	
3 0700-Along Cross Result	55 0	S 160	177	87 0	S 160	no observation			35
							13	off	
							38	140	
3 1300-Along Cross Result							26	S	
							8	off	
							27	142	
3 1900-Along Cross Result							17	S	
							3	off	
							17	150	
4 0100-Along Cross Result							15	S	
							2	off	
							15	152	
4 0700-Along Cross Result	12 0 12	N 152 340		7 0 7	S 160	South	18	S	2
							6	off	
							6	86	
4 1300-Along Cross Result							4	S	
							3	on	
							5	195	
4 1900-Along Cross Result							1	N	
							5	on	
							5	259	
5 0100-Along Cross Result							1	N	
							2	off	
							2	29	
5 0700-Along Cross Result	122 0	S 160	189	76 0	S 160	North	62	S	28
							9	off	
							30	143	
5 1300-Along Cross Result	122	160		76	160		38	S	
							14	off	
							40	139	
5 1900-Along Cross Result							24	S	
							8	off	
							25	142	

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Feb 1992

Alongshore Cross-shore Resultant ---- Time	Day	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter	
		Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	Speed
6 0100-Along Cross Result										20	S
										8	off
										21	138
6 0700-Along Cross Result	6	41 49 63	S on 210	165	76 0 76	S 160	no observation			15	S
										6	off
										16	139
6 1300-Along Cross Result										31	S
										13	off
										33	138
6 1900-Along Cross Result										36	S
										13	off
										38	141
7 0100-Along Cross Result	7									42	S
										18	off
										46	137
7 0700-Along Cross Result	7	41 24 47	S on 191	177	17 26 31	S on 216	North 26 N			45	S
										18	off
										48	139
7 1300-Along Cross Result										49	S
										19	off
										52	139
7 1900-Along Cross Result										56	S
										17	off
										58	143
8 0100-Along Cross Result	8									40	S
										17	off
										44	137
8 0700-Along Cross Result	8	38 0 38	S on 160	171	68 7 68	S off 154	North 30 S			26	S
										8	off
										27	142
8 1300-Along Cross Result										35	S
										15	off
										38	136
8 1900-Along Cross Result										30	S
										10	off
										32	142
9 0100-Along Cross Result	9									22	S
										2	off
										22	154
9 0700-Along Cross Result	9	18 0 18	S on 160	152	55 6 56	S on 166	North 20 S			15	S
										6	off
										16	138
9 1300-Along Cross Result										10	S
										2	off
										10	150
9 1900-Along Cross Result										10	S
										0	
										10	160
10 0100-Along Cross Result	10									13	S
										6	off
										14	134
10 0700-Along Cross Result	10	15 5 16	S on 177	165	61 6 61	S on 166	North 18 S			18	S
										7	off
										19	140
10 1300-Along Cross Result										14	S
										6	off
										15	135
10 1900-Along Cross Result										9	S
										3	off
										9	141

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
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 on = onshore off = offshore

Table 4: Current Data (Continued)
Feb 1992

Day	Alongshore Cross-shore Resultant ---- Time	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter	
		Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519
11 0100-Along Cross Result										6 S
11 0700-Along Cross Result	41 0 41 160		140	0 6 6 70			North	4 S		2 off 6 136
11 1300-Along Cross Result										9 S
11 1900-Along Cross Result										4 off 10 138
12 0100-Along Cross Result										23 S
12 0700-Along Cross Result	41 0 41 160		177	87 13 88 169	S on			33 S		10 off 25 137
12 1300-Along Cross Result										14 S
12 1900-Along Cross Result										10 off 17 125
13 0100-Along Cross Result										15 S
13 0700-Along Cross Result	0 0 0 0		165	61 37 71 129	S off		North	18 S		8 off 17 133
13 1300-Along Cross Result										30 138
13 1900-Along Cross Result										43 S
14 0100-Along Cross Result										17 off 46 139
14 0700-Along Cross Result	5 1 5 143		140	0 0 0 0				14 S		14 off 35 137
14 1300-Along Cross Result										19 S
14 1900-Along Cross Result										8 off 11 113
15 0100-Along Cross Result										6 N
15 0700-Along Cross Result	44 0 44 340	N	151	30 0 30 340	N			43 N		5 on 6 294
15 1300-Along Cross Result										2 N
15 1900-Along Cross Result										10 off 10 58
										4 S
										0
										4 160
										2 N
										2 off 3 26
										4 N
										0
										4 340
										5 N
										6 on 8 293
										9 S
										2 on 9 170

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 on = onshore off = offshore

Table 4: Current Data (Continued)
Feb 1992

Alongshore Cross-shore Resultant Time Day	Pier Measurements						Beach Measurements			Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	Speed	Dir
16 0100-Along Cross Result										8	N
										12	on
										14	283
16 0700-Along Cross Result	14 8 off	N 156	38 15	N off		South	23	N		8	N
	16	11	41	2						6	on
										10	303
16 1300-Along Cross Result										7	N
										8	on
										11	293
16 1900-Along Cross Result										8	S
										4	off
										9	132
17 0100-Along Cross Result										5	S
										6	off
										8	112
17 0700-Along Cross Result	10 2 on	N 177	87 0	S		North	20	S		5	N
	10	331	87	160						4	off
										7	20
17 1300-Along Cross Result										14	N
										2	off
										14	347
17 1900-Along Cross Result										1	S
										1	off
										2	110
18 0100-Along Cross Result										12	S
										7	off
										14	128
18 0700-Along Cross Result	24 4 off	S 165	14 0	N		North	37	S		22	S
	25	151	14	340						11	off
										24	134
18 1300-Along Cross Result											
18 1900-Along Cross Result											
19 0100-Along Cross Result											
19 0700-Along Cross Result	0 6 off		140	10 3 off	N		0				
	6	70		11	357	South					
19 1300-Along Cross Result											
19 1900-Along Cross Result											
20 0100-Along Cross Result										11	S
										5	off
										12	135
20 0700-Along Cross Result	30 9 off	S 140	17 3 off	S		North	8	S		6	S
	32	143	18	151						5	off
										8	117
20 1300-Along Cross Result										13	S
										6	off
										15	135
20 1900-Along Cross Result										3	N
										11	off
										11	55

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on = onshore off = offshore

Table 4: Current Data (Continued)
Feb 1992

Alongshore Cross-shore Resultant ---- Time	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter		
	Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	Speed	
Day											Dir
21 0100-Along Cross Result									7	S	
21 0700-Along Cross Result	7 10 12	N off 36	140	9 7 11	N off 17	South	6	N	0 0 4	160	
21 1300-Along Cross Result									0 0 0		
21 1900-Along Cross Result									4 2 4	N on 317	
22 0100-Along Cross Result									0 5 5	off 70	
22 0700-Along Cross Result	21 5 22	N off 354	140	0 0 0		South	2	N	9 1 9	N 340	
22 1300-Along Cross Result									7 1 7	S off 150	
22 1900-Along Cross Result									2 0 2	S 160	
23 0100-Along Cross Result									8 4 9	N off 8	
23 0700-Along Cross Result	16 0 16	N off 340	143	9 2 9	N on 329	South	4	N	4 1 4	S on 168	
23 1300-Along Cross Result									8 7 11	S off 117	
23 1900-Along Cross Result											
24 0100-Along Cross Result									1 3 4	N off 48	
24 0700-Along Cross Result	17 5 18	S on 177	152	0 0 0		North	3	N	2 3 3	S off 114	
24 1300-Along Cross Result									10 7 12	S off 126	
24 1900-Along Cross Result									26 14 30	S off 132	
25 0100-Along Cross Result									30 11 32	S off 140	
25 0700-Along Cross Result	29 0 29	S off 160	165	61 0 61	S off 160	North	21	S	35 11 36	S off 142	
25 1300-Along Cross Result									37 15 39	S off 138	
25 1900-Along Cross Result									31 11 32	S off 140	

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Table 4: Current Data (Concluded)
Feb 1992

Alongshore Cross-shore Resultant ---- Time	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Dye at Mid-Surf Zone (surface)		Location	Dye 12m offshore (surface)	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	
Day	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir
26 0100-Along Cross Result									21	S
									15	off
									26	125
26 0700-Along Cross Result	30 5 31	S on 169	165	0 0 0	North	12	S		13	S
									6	off
									14	136
26 1300-Along Cross Result									33	S
									22	off
									39	126
26 1900-Along Cross Result									29	S
									10	off
									31	141
27 0100-Along Cross Result									13	S
									0	
									13	160
27 0700-Along Cross Result	22 7 23	S off 143	152	0 13 13	North	29	S		10	S
									6	off
									12	131
27 1300-Along Cross Result									9	S
									5	off
									11	130
27 1900-Along Cross Result									1	S
									4	on
									4	233
28 0100-Along Cross Result									16	N
									6	on
									17	320
28 0700-Along Cross Result	9 9 13	N off 25	140	9 0 9	South	26	N		12	N
									3	on
									13	326
28 1300-Along Cross Result									12	N
									7	on
									14	310
28 1900-Along Cross Result									1	N
									3	on
									3	265
29 0100-Along Cross Result									17	N
									8	on
									19	316
29 0700-Along Cross Result	41 0 41	S 159 160		28 0 28	North	61	S		5	N
									4	on
									6	301
29 1300-Along Cross Result									48	S
									15	off
									50	142
29 1900-Along Cross Result									43	S
									14	off
									45	142

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 on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Feb 1992

Day	Time	Wave Approach Angle at Pier End		Radar Wave Angle deg from True N	Width of Surf Zone,m	Water Characteristics at Pier End		
		Primary	Secondary			Temp.,C	Density g/cc	Secchi Vis.,m
1	1400	50	25	50	101	7.8		1.2
2	0925	25			60	5.6		1.2
3	0743	60	0	70	242	5.9		1.2
4	0805	80	15		33	6.7		1.5
5	0810	30		45	155	6.4		0.9
6	0715	40		60	191	6.6		0.6
7	0830	45	65	85	357	6.6	Hydro- meter	0.3
8	0900	70			79	6.1		0.9
9	0925	20			46	6.1		1.5
10	1045	50	80	50	103	6.1	broken	0.9
11	1000	115	10	inoperative	75	5.6		1.5
12	0845	40		40	235	5.6		0.9
13	0900	45	105		127	5.3		1.8
14	1015	120	10		61	6.0		1.2
15	0940	95			12	6.1		2.1
16	0855	90	110		28	7.2		1.5
17	1230	45			167	6.7		3.7
18	0845	100	25	90	138	7.0		2.1
19	0910	130	155		Fog	7.2		5.5
20	0905	120	5		73	7.2		4.3
21	0920	none visible			4	7.8		4.6
22	0905	50	110		3	7.8		4.0
23	0930	105			11	7.8		3.4
24	1040	115	25		98	7.9		3.7
25	0925	50		50	138	7.9		2.4
26	0925	100	40	55	134	7.8		4.0
27	0813	40			76	7.2		2.4
28	0811	100			7	7.2		2.7
29	0925	10	150	95	26	7.8		2.1

PART VI: WATER LEVELS

Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Feb 1992

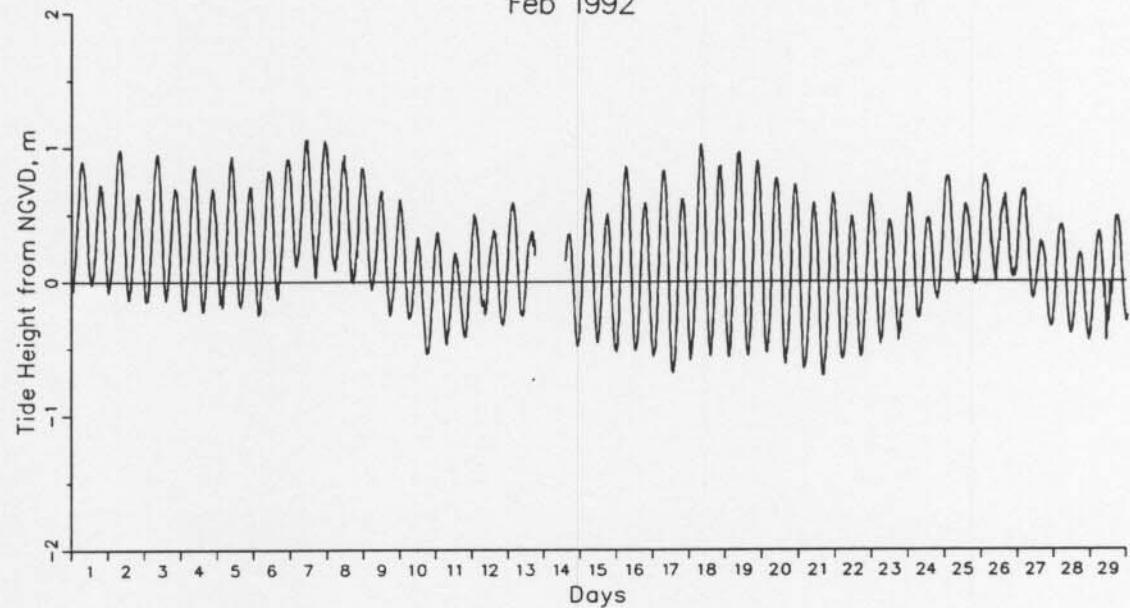


Figure 4. Water level time history

Monthly Water Levels,m NGVD

Extreme Low = -0.71 on day 21 at 1536 EST
Extreme High = 1.06 on day 7 at 1006 EST
Monthly Mean = 0.18
Mean Low = -0.32
Mean High = 0.67
Mean Range = 0.98

Table 6: Water Levels,m NGVD

		Feb 1992			
Mid-Cycle		Low	High	Mean	Range
Day	Time				
1	30	-0.07	0.90	0.44	0.98
1	1255	-0.08	0.73	0.31	0.81
2	120	-0.14	0.98	0.46	1.12
2	1345	-0.15	0.66	0.24	0.82
3	210	-0.15	0.95	0.42	1.10
3	1436	-0.22	0.70	0.25	0.92
4	301	-0.23	0.87	0.32	1.10
4	1526	-0.20	0.70	0.23	0.90
5	351	-0.19	0.94	0.36	1.13
5	1616	-0.25	0.71	0.22	0.97
6	442	-0.13	0.83	0.34	0.96
6	1707	0.11	0.92	0.50	0.81
7	532	0.03	1.06	0.57	1.03
7	1757	0.08	1.05	0.57	0.97
8	622	-0.01	0.95	0.45	0.96
8	1848	-0.06	0.85	0.39	0.92
9	713	-0.26	0.68	0.21	0.94
9	1938	-0.28	0.62	0.16	0.90
10	803	-0.55	0.34	-0.11	0.88
10	2028	-0.47	0.37	-0.04	0.84
11	854	-0.42	0.22	-0.11	0.64
11	2119	-0.25	0.51	0.11	0.76
12	944	-0.33	0.39	0.04	0.72
12	2209	-0.26	0.60	0.18	0.86
13	1034				
13	2300			Operator Error	
14	1125				
14	2350	-0.46	0.69	0.16	1.16
15	1215	-0.53	0.51	-0.02	1.04
16	40	-0.52	0.87	0.21	1.39
16	1305	-0.56	0.59	-0.01	1.16
17	131	-0.69	0.84	0.13	1.52
17	1356	-0.61	0.62	-0.01	1.23
18	221	-0.56	1.03	0.25	1.58
18	1446	-0.57	0.87	0.15	1.44
19	311	-0.56	0.97	0.21	1.53
19	1537	-0.54	0.90	0.18	1.44
20	402	-0.62	0.77	0.11	1.39
20	1627	-0.65	0.73	0.05	1.38
21	452	-0.71	0.59	-0.06	1.30
21	1717	-0.58	0.66	0.01	1.24
22	543	-0.57	0.49	-0.06	1.06
22	1808	-0.47	0.65	0.09	1.12
23	633	-0.45	0.46	0.01	0.90
23	1858	-0.27	0.66	0.18	0.94
24	723	-0.22	0.48	0.14	0.69
24	1949	-0.05	0.79	0.39	0.85
25	814	-0.02	0.58	0.27	0.60
25	2039	0.01	0.80	0.44	0.79
26	904	0.00	0.66	0.32	0.66
26	2129	-0.13	0.69	0.33	0.82
27	955	-0.34	0.30	0.02	0.64
27	2220	-0.39	0.42	0.06	0.82
28	1045	-0.44	0.22	-0.11	0.66
28	2310	-0.44	0.38	0.00	0.82
29	1135	-0.30	0.49	0.10	0.80

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Geodimeter surveying system; a Geodimeter 140-T self-tracking, electronic theodolite, distance meter, in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in January 1992 and the surveys in February 1992 on profile line 188, located 517 m south of the pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1992. Cross-hatched areas indicate changes to the annual envelope which occurred in February.

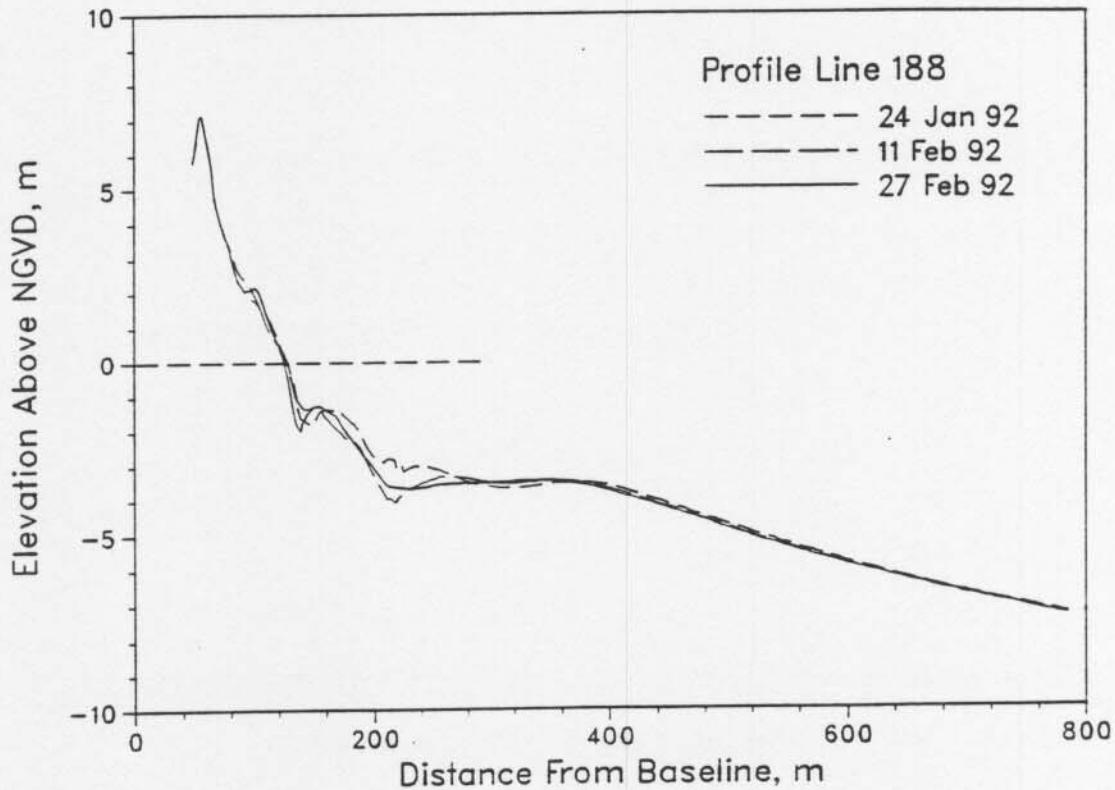


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

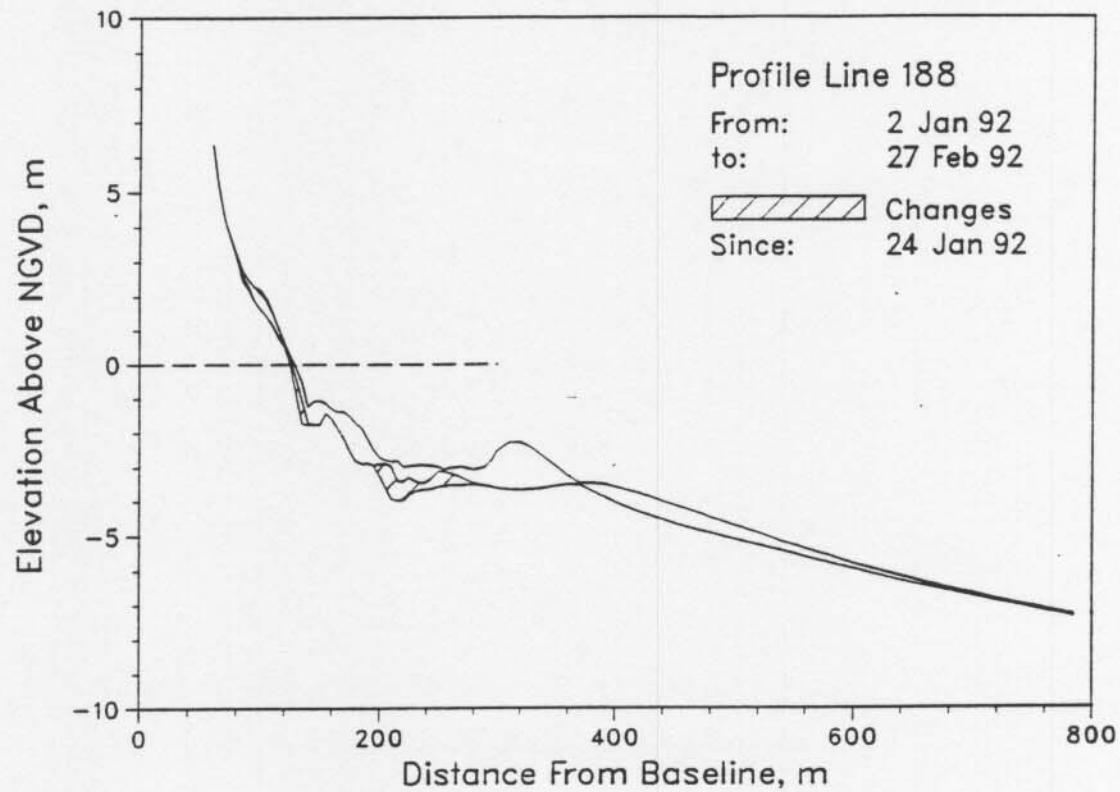


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 11 February. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

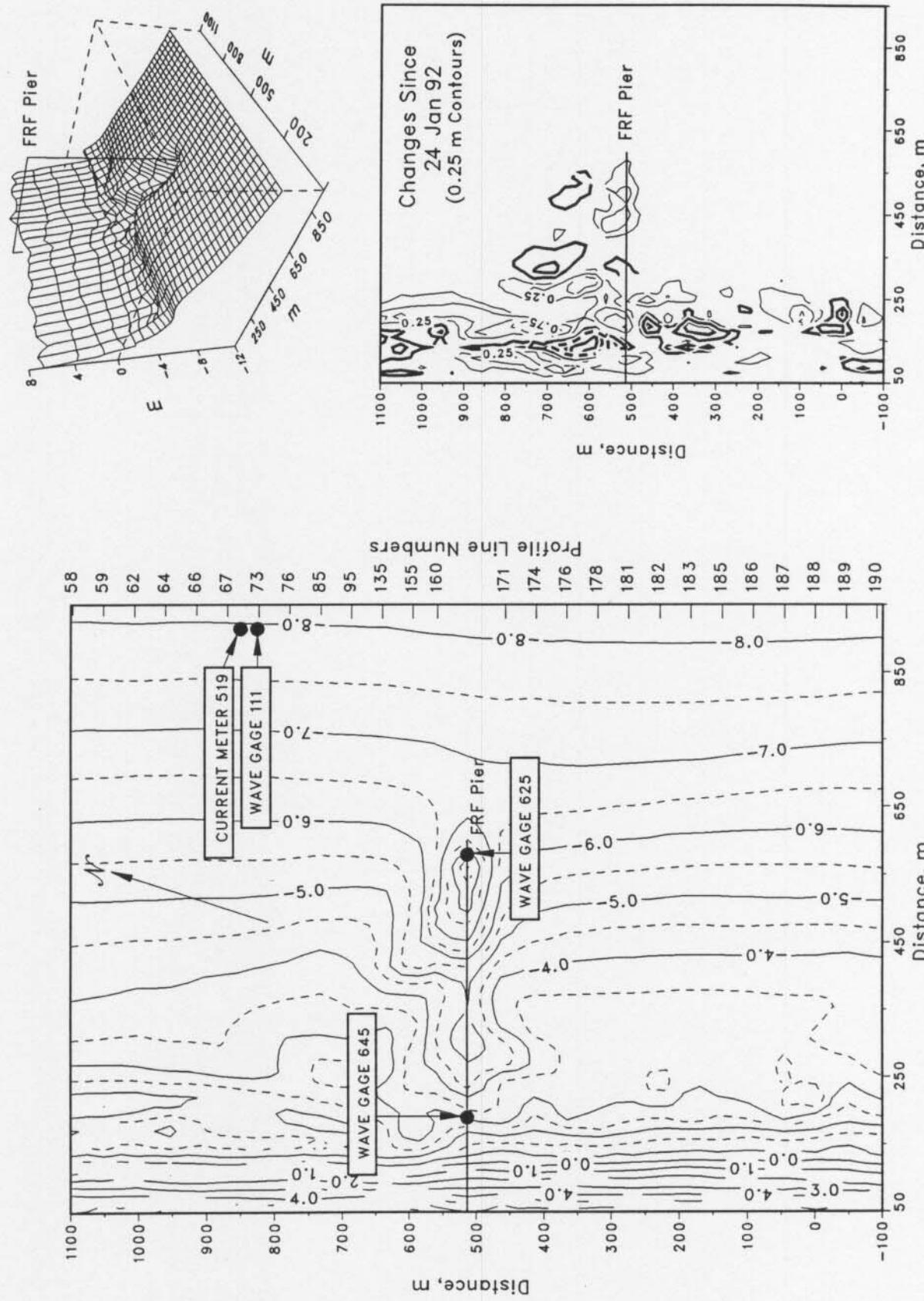


Figure 7. FRF bathymetry 11 Feb 92 depths relative to NGVD

PART VIII. SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the wave height H_{mo} at the seaward end of the pier (i.e. as measured near the end of the pier) exceeded 2 m.

<u>Start</u>	<u>End</u>
6 Feb (1216)	8 Feb (1816)

B. Storm Synopsis.

On the morning of 6 February, a low pressure system crossed northern Florida from the Gulf of Mexico to the Atlantic, and headed north along the Atlantic coast. By 7 February, the storm was off the North Carolina coast and was proceeding north toward New England. The maximum H_{mo} (at gage 625) of 2.9 meters ($T_p = 10.7$ sec) occurred at 1034 EST on 7 February. Maximum winds (from northeast) reached 14.3 m/s on 7 February at 0316 EST. The minimum atmospheric pressure of 996 mb was measured at 1334 EST also on 7 February. There was no precipitation.

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